WHAT IS CLAIMED IS:

1. An apparatus for performing an unmixed combustion of coal to produce separate streams of substantially pure hydrogen gas, sequestration-ready carbon dioxide gas and oxygen depleted air, said apparatus consisting of first, second and third reactors containing a mixture of fluidized solids circulating among all three reactors, said circulating solids containing coal, calcium compounds present as CaO, $CaCO_3$, and mixtures thereof, and containing iron compounds present as FeO, Fe_2O_3 and mixtures thereof.

2. An apparatus according to claim 11, wherein superheated steam and compressed air are used to fluidize the calcium and iron containing solids circulating in said first, second and third reactors and to cause the coal to undergo unmixed combustion producing separate streams of relatively pure carbon dioxide, oxygen depleted air and pure and hydrogen.

3. An apparatus according to claim 11, wherein said first reactor receives inputs of coal and steam and produces an output gaseous stream of wet hydrogen gas, said second reactor produces an output stream of wet CO_2, and said third reactor receives an input stream of air and produces an output stream of oxygen depleted air.

4. An apparatus according to claim 11, wherein superheated steam is used to fluidize the solids circulating in said second reactor and wherein heat generated by the combustion of a portion of said

unreacted coal and heat from said superheated steam causes the decomposition of $CaCO_3$ back to CaO.

5. An apparatus according to claim 11, wherein compressed air is used to fluidize said solids circulating in said third reactor and oxidizes FeO to Fe_2O_3 to generate additional heat.

6. An apparatus according to claim 15, wherein said additional heat is used to generate electricity through expansion across a gas turbine engine.

7. An apparatus according to claim 11, wherein the temperature in the first reactor is in the range 650°C to 850°C.

8. An apparatus according to claim 11, wherein the temperature in the second reactor is in the range 1000°C to 1100°C.

9. An apparatus according to claim 11, wherein the temperature in the third reactor is in the range 1400°C to 1600°C.

10. An apparatus according to claim 11, wherein the pressure in the reactor system is in the range 2 to 20 atmospheres.